The Ohio State University/ Department of Animal Sciences / Equine Program

Influence of Time of Day of Vaccination on Immune Response in Mature Quarter Horse Mares

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ABSTRACT

Studies in multiple species have shown that serum antibody concentrations were higher when antigen exposure occurs in the evening. Increasing antibody response to vaccination by changing the time of day of vaccination may translate into increased vaccine efficacy and improved horse health. In this study, eight Quarter Horse mares (11.0 ± 6.8 yr) were used to evaluate the time of day of vaccination on IgA, IgM, IgG, IgGa, IgGb, and IgG(T) concentrations in response to vaccination. Mares were randomly assigned to one of two vaccination groups: AM or PM. All mares received 0.25% BW of a 12% CP pelleted concentrate with mixed grass hay and water *ad libitum* and were housed in outdoor paddocks with access to shelter. Mares in the AM and PM groups were vaccinated at 0700 and 1900 hr, respectively. All mares were vaccinated against Eastern and Western equine encephalomyelitis, equine rhinopneumonitis (EHV-1 and EHV-4), equine influenza (type A2), tetanus and West Nile virus. Blood samples were taken via jugular venipuncture at 1300 hr immediately prior to vaccination (d 0) and on d 7, 14, 21 and 28 post-vaccination. Sera samples were measured for immunoglobulin concentrations using commercial ELISA kits. Data were analyzed using PROC MIXED of SAS with d 0 as a covariate. A p-value of ≤ 0.05 was considered statistically significant. IgA concentrations increased in response to vaccination and tended to be higher in the PM group (P = 0.07). There were no differences in IgM, IgGa or IgG(T) concentrations between the AM and PM groups. The PM group had significantly higher IgGb concentrations on 7, 14, 21 and 28 d post-vaccination (P < 0.01). However, total IgG concentrations were only increased in the PM group on d 21 post-vaccination (P < 0.01). Further research is needed to determine optimum time for vaccination of horses.

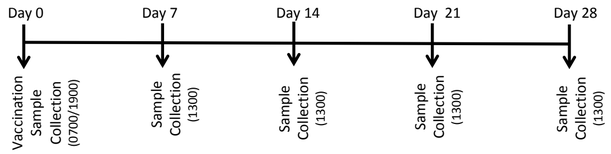
INTRODUCTION

- Immunoglobulins are glycoproteins that are produced by plasma cells after stimulation by an antigen. They are also referred to as antibodies.
- The goal of vaccinating is to prime the humoral and cellular immunity without causing disease. In vaccinating a horse, the vaccine antigen is stimulating a humoral response in the immunoglobulins.
- Recent research suggests that humoral immune response may be higher when antigen exposure occurs in the evening [1].

OBJECTIVE

The objective of this study is to determine if time of day vaccination influences immune responses in mature Quarter Horse mares.

EXPERIMENTAL DESIGN



METHODS

- Eight mature Quarter Horse mares (11.0 ± 6.8 yr) were randomly assigned into one of two vaccination groups: AM or PM.
- All horses were vaccinated intramuscularly with two commercially available vaccines.
- Blood samples were collected via jugular venipuncture immediately prior to vaccination (d 0) and on d 7, 14, 21 and 28 post-vaccination (Fig. 1).
- Serum samples were evaluated using commercially available ELISA kits specific for equine IgA, IgM, IgGa, IgGb, IgG(T) (Bethyl Laboratories Inc.).
- Data were analyzed using the PROC MIXED SAS v 9.3 and values of P ≤ 0.05 were considered statistically significant (SAS Institute Inc.).
- The intra-assay coefficient of variation was less than 3.01%, the inter-assay variation less than 2.37%, and the minimal detectable concentration for IgA, IgM and IgG(T) was 15.6 ng/ml and IgGa and IgGb was 3.12 ng/ml.

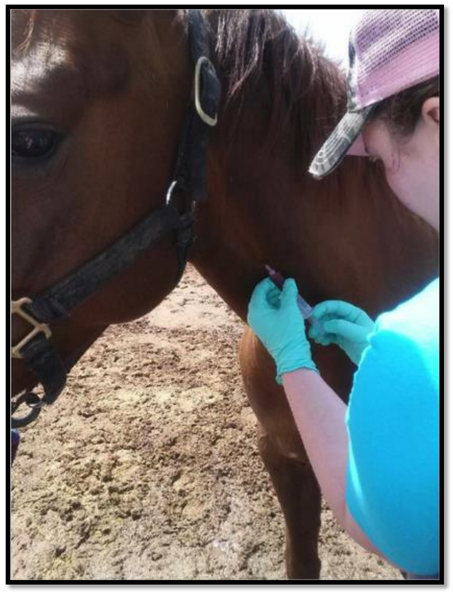


Figure 1 Taking a blood sample via jugular venipuncture from Ashley, a Quarter Horse mare used in the study.

RESULTS

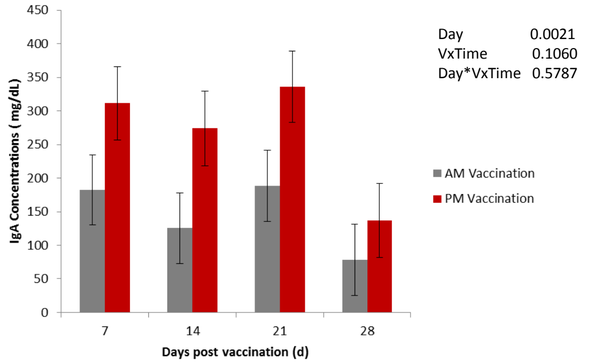


Figure 2 IgA concentrations in response to vaccination time. IgA concentrations increased in response to vaccination and tended to be higher in the PM group (P = 0.07)

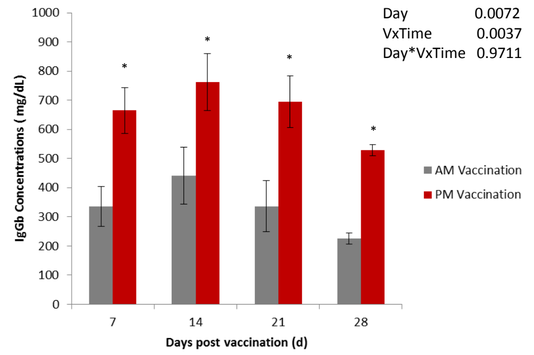


Figure 4 IgGb concentrations in response to vaccination time.
*P Values for d 7 = 0.0057, d 14 = 0.0329, d 21 = 0.0104, d 28 = <.0001.

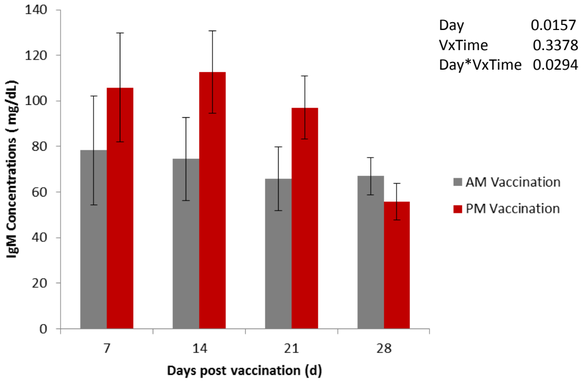


Figure 3 IgM concentrations in relation to vaccination time.

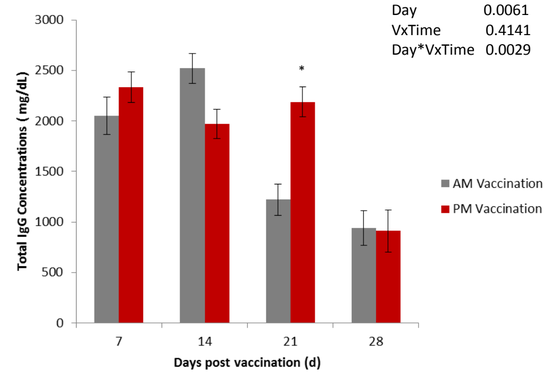


Figure 5 Total IgG (IgGa, IgGb, IgG(T)) concentrations in relation to vaccination time.
*P Values for d 21 = .0094

DISCUSSION

- IgA concentrations increased in response to vaccination and tended to be higher in the PM vaccination group (P = 0.07). There were no differences in IgM, IgGa or IgG(T) concentrations between the mares in the AM and PM vaccination groups.
- Mares in the PM vaccination group had significantly higher IgGb concentrations on d 7, 14, 21 and 28 d post-vaccination (P < 0.01). However, total IgG concentrations were only increased in the PM vaccination group on d 21 post-vaccination (P < 0.01).
- Recent research in mice has shown that immunoglobulin levels were higher when the animal was vaccinated in the evening [3].
- There is limited information on the Quarter Horses' immune system, but in the present study, the horses vaccinated in the evening tended to show a higher immune response than those vaccinated in the morning.

CONCLUSION

- This study suggests that there may be an influence of vaccination time in horses, it seems that there is a greater immune response when the horse is exposed to the antigen in the evening.
- IgGb concentrations for horses vaccinated in the PM group were significantly higher that horses vaccinated in the AM.
- Further research is needed in this area to determine the optimum time for vaccination.

BIBLIOGRAPHY

[1] McGlynn, O. F., J. A., Browne, C. M. Blake, and B. A. Murphy. 2010. Time of day influences cytokine and clock gene response to immune stimulation in equine whole blood. Ani. Gen. 41: 202–204. doi: 10.1111/j.1365-2052.2010.02109.x
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[3] Cernysiov V., N. Gerasimcik, M. Mauricas, and I. Girkontaite. 2009. Regulation of T-cell-independent and T-cell- dependent antibody production by circadian rhythm and melatonin. Int. Imm. 22:25-34. doi:10.1093/intimm/dxp109